『Maple Bus 1.0』Peripheral Hardware Specifications

Maracas Controller

Rev 0.99

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    0.99   March 1st, 2000   First edition

*   For items affected by the latest revisions and previous revisions, added items are set off by   , and deleted items are set off by ▬.

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1   Maracas Controller Configuration

1.1 Maracas Controller definitions

It conforms to the "Maple Bus 1.0" Standard Specifications and belongs to Function Type "FT_0: Controller".
However, when using multiple controllers, a special software library is required in order to use commands that are not defined for the function type "FT_0: Controller."

1.2 Function elements

The Maracas Controller comprises the following elements from among the function elements from among the function elements that can be defined by the "FT_0：Controller" function.

・Digital direction keys A	: None
・Digital direction keys B	: None
・Digital buttons	: A,B,C,D,Z,Start
・Analog direction keys A	: A3,A4（Xa,Ya）
・Analog direction keys B	: A5,A6（Xb,Yb）
・Analog levers	: None

1.3 Detailed description of constituent elements

Each of the Maracas Controller function elements is described in detail in the following:

(1) Digital buttons

The left and right maracas share the same functions.

The functions assigned to the digital buttons are listed in the table below.

The shake switches in the maracas turn ON (='0') when the maracas are shaken, and turn OFF (='1') when the maracas are still.

The buttons on top of the maracas turn ON (='0') when pressed, and turn OFF (='1') when released.

A maraca's "Lost Flag" is OFF (='1') when the maraca is positioned inside the measurement range, and turns ON (='0') when the maraca is outside of the measurement range, or when a coordinate overflow occurs.

Operation	Right maraca	Left maraca
Maraca shake switch	A	B
Button on top of maraca	Start	C
Maraca "Lost Flag"	Z	D

Fig. 1.1 Digital buttons

(2) Analog direction keys A

The analog coordinate values (Xa,Ya) indicate the position of the left maraca.

These values change over a range from a minimum value of '00h' to a maximum value of 'FFh.'

There are no initial values; the current position of the maraca is used.

When the Lost Flag for the maraca is ON, the coordinate values (Xa,Ya) are undefined values.

As shown in the diagram below, the range of data for the analog values resembles a distorted circle, but this range is subject to change, depending on the surrounding environment (especially in the diagonal direction).
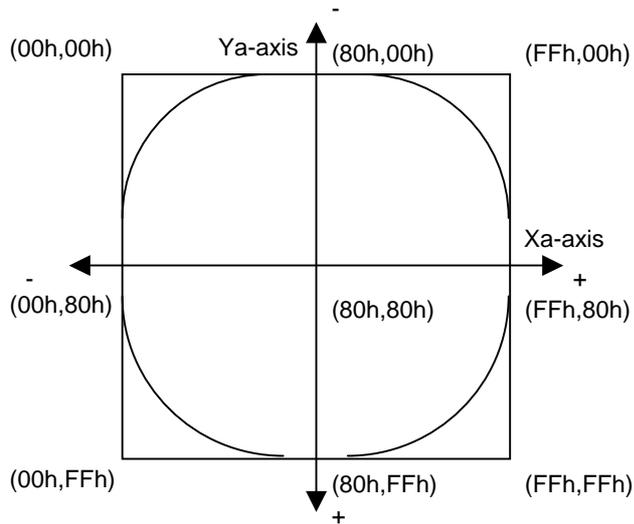

Fig 1.2 Data range of analog direction keys A

(3) Analog direction keys B

The analog coordinate values (Xb,Yb) indicate the position of the right maraca.

These values change over a range from a minimum value of '00h' to a maximum value of 'FFh.'

There are no initial values; the current position of the maraca is used.

When the Lost Flag for the maraca is ON, the coordinate values (Xb,Yb) are undefined values.

As shown in the diagram below, the range of data for the analog values resembles a distorted circle, but this range is subject to change, depending on the surrounding environment (especially in the diagonal direction).
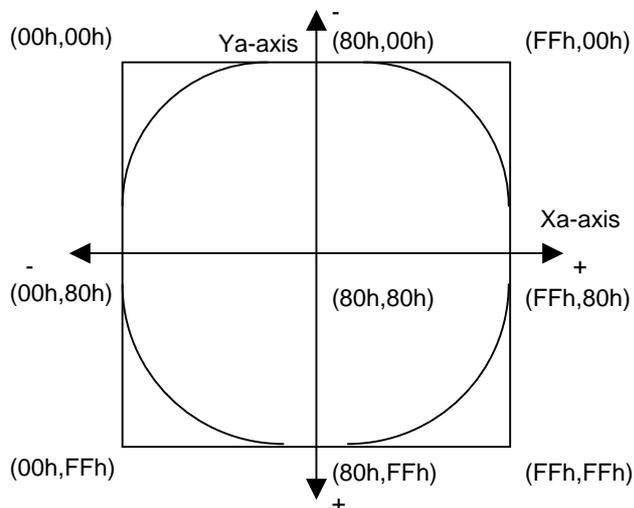
Fig 1.3 Data range of analog direction keys B

2 Maracas Controller Operations and Limitation

The Maracas Controller conforms to the "FT_0:Controller".

When using multiple controllers, a special software library is required.

2.1 Principles of Operation

The method for detecting the position of a maraca is described below.

Ultrasound is used to detect the positions of the left and right maracas.

The coordinates of the maracas are determined by measuring the travel time of the ultrasonic waves.

The lower portion of each maraca contains an ultrasonic emitter, and ultrasonic sensors are located at the left and right ends of the base unit set up on the floor.

The position of each of the maracas is determined by measuring the time that it takes an ultrasonic wave that is produced by the emitters in each maraca to reach the left and right ultrasonic sensors in the base unit, and then solving the following simultaneous quadratic equations:

$$\begin{cases} (X - a)^2 + Y^2 = L1^2 \\ (X + a)^2 + Y^2 = L2^2 \end{cases}$$

X,Y   : X, Y coordinates of maraca

a   : X coordinate of sensor

L1,L2   : Distances between maraca and sensor
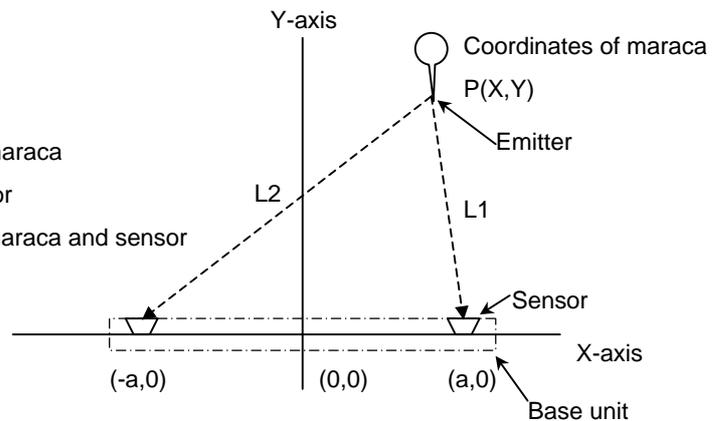
Fig. 2.1 Coordinate Calculation Method

The distance of each maraca is calculated for the left maraca first, and then the right maraca.

The measurement of the left and right maracas is completed within 16.6ms after sending the [Get Condition] signal.

If the distance to a maraca (either L1 or L2) is outside of the measurement range, or if the coordinate value for a maraca (either X or Y) goes negative or exceeds 'FFh,' the corresponding "Lost Flag" is set to ON.

2.2 Initial Setup

This section describes operation after the power is turned on and after a reset.

After the power is turned on or a reset, the controller begins the ultrasonic wave emission timing adjustment process.   During this adjustment, input from the buttons and switches is disabled, the maraca coordinates are fixed at (80h, 80h), and the maraca "Lost Flag" is set to ON.

The adjustment interval is as follows, depending on which port the controller is connected to:

      Port A: 4 seconds ([Get Condition] is received 240 times)

      Port B: 5 seconds ([Get Condition] is received 300 times)

      Port C: 6 seconds ([Get Condition] is received 360 times)

      Port D: 7 seconds ([Get Condition] is received 420 times)

The controller begins operating normally after the adjustment period ends.

2.3 Operation with One Controller

When there is only one Maracas Controller, it operates as is.   (Adjustment is not needed.)

The special adjustment library is not needed.

2.4 Operation with Two or More Controllers

When using multiple Maracas Controllers, the ultrasonic wave emission timing has to be adjusted in order to avoid interference among the ultrasonic waves output by each set of maracas.

The Maracas Controllers automatically adjust the emission timing by receiving the ultrasonic waves produced in the vicinity after the power is turned on or after a reset.

However, because adjustment is not always possible with this method, the Maracas library, which is special software that is used to adjust the ultrasonic wave emission timing, is needed.

3   Device ID

In accordance with the device ID definition in the "Maple Bus 1.0" Standard Specifications.

The notation is that of the host's memory image.

3.1 Configuration of the "Maple Bus 1.0" device ID

The device ID consists of 16 bytes (128 bits).

bit	7	6	5	4	3	2	1	0
1st Data	0	0	0	0	0	0	0	0
2nd Data	0	0	0	0	0	0	0	0
3rd Data	0	0	0	0	0	0	0	0
4th Data	0	0	0	0	0	0	0	1
5th Data	0	0	0	0	0	0	0	0
6th Data	0	0	1	1	1	1	0	0
7th Data	0	0	0	0	1	0	0	1
8th Data	0	0	0	0	1	1	1	1
9th Data	0	0	0	0	0	0	0	0
10th Data	0	0	0	0	0	0	0	0
11th Data	0	0	0	0	0	0	0	0
12th Data	0	0	0	0	0	0	0	0
13th Data	0	0	0	0	0	0	0	0
14th Data	0	0	0	0	0	0	0	0
15th Data	0	0	0	0	0	0	0	0
16th Data	0	0	0	0	0	0	0	0

Fig. 3.1 Configuration of Device ID

1st Data to 4th Data	: Designates type of function that the peripheral is equipped with.	(FT)
5th Data to 8th Data	: Designates the function definition block of the first function.	(FD1)
9th Data to 12th Data	: Designates the function definition block of the second function.	(FD2)
13th Data to 16th Data	: Designates the function definition block of the third function.	(FD3)

(1) FT_0-FT_{31} : Function type

Designates the function that the peripheral is equipped with.

There are 32 function types altogether.

(2) $FD1_{31}$-$FD1_0$: Function definition block

This is for the block defining the individual elements making up the function.

4   Data Formats

The Maracas Controller data formats are explained in the following.

The Maracas Controller data has a read format and a write format.

The notation is that of the host's memory image.

4.1   Read format

This is the key data format when the controller function data are read.

When the host transmits Get Condition, the Maracas Controller returns data according to the data format. The command is Data Transfer.

bit	7	6	5	4	3	2	1	0
1st Data	1	1	1	1	Start	A	B	C
2nd Data	1	1	1	1	D	1	1	Z
3rd Data	0	0	0	0	0	0	0	0
4th Data	0	0	0	0	0	0	0	0
5th Data	$A3_7$	$A3_6$	$A3_5$	$A3_4$	$A3_3$	$A3_2$	$A3_1$	$A3_0$
6th Data	$A4_7$	$A4_6$	$A4_5$	$A4_4$	$A4_3$	$A4_2$	$A4_1$	$A4_0$
7th Data	$A5_7$	$A5_6$	$A5_5$	$A5_4$	$A5_3$	$A5_2$	$A5_1$	$A5_0$
8th Data	$A6_7$	$A6_6$	$A6_5$	$A6_4$	$A6_3$	$A6_2$	$A6_1$	$A6_0$

Fig. 4.1   Read format

Key data explanation

1st	: Digital button data. (ON = '0', OFF ='1')
2nd	: Digital button data. (ON = '0', OFF = '1')
3rd, 4th	: Analog axis 1 (A1,2) data. (Used)
5th	: Analog axis 3 (A3) data. (Xa-axis)
6th	: Analog axis 4 (A4) data. (Ya-axis)
7th	: Analog axis 5 (A5) data. (Xb-axis)
8th	: Analog axis 6 (A6) data. (Yb-axis)

4.2   Write format

This format is used when writing file data to the Maracas Controller.

This data is used to adjust the maraca ultrasonic wave emission timing.

The host uses "Set Condition" to send data.

This format is used by the special Maracas library.

Data Address	Data	Setting example	Description
+0000	Command code	0Eh	Specifies Set Condition
+0001	Destination AP	00h	Specifies Port A
+0002	Origin AP	20h	No expanded device
+0003	Data size	03h	Data size is 12byte
+0004	Function type	00h	The function type specifies the
+0005		00h	"Controller".
+0006		00h	
+0007		01h	
+0008	Emission interval	02h	Ultrasonic wave emission interval (when operating with two controllers)
+0009	Emission counter	00h／01h	Count until emission (when operating with two controllers)
+000A	Y-axis offset	00h	Settings cannot be changed
+000B	Ultrasonic counter offset	10h	
+000C	A/D X-axis R	9Ah	
+000D	A/D X-axis L	66h	
+000E	A/D Y-axis D	A8h	
+000F	A/D Y-axis U	58h	

Fig. 4.1 Write format

Emission interval: This specifies the interval for emission of ultrasonic waves in terms of the number of times "Get Condition" is received.

After "Get Condition" has been received the number of times set by this value, an ultrasonic wave is emitted. When using two controllers, set this value to '02h.' The value of this setting should equal the number of controllers. If a value less than '02h' is set, an unexpected value may be generated for the maraca coordinates, so do not set a value less than '02h.'

Emission counter: This sets how many more times "Get Condition" should be received before the ultrasonic wave is emitted. The timing of ultrasonic wave emissions from multiple Maracas Controllers can be separated out by setting a different value in this setting for each port to which a Maracas Controller is connected. The following range of values can be set:

00h $\leqq$ (Emission counter setting) $<$ (Emission interval setting)

When using two controllers, set '00h' for the first controller and '01h' for the second controller.

Others: Do not change these settings. Changing any of these values could result in an unexpected value for the maraca coordinates.

5   Maracas Controller Information

This chapter explains information about specific devices (device statuses).

5.1 Types

Fixed Device Status

This is a set form of device status, consisting of 112 bytes in all, that must be designated.

Free Device Status

The individual devices can use this status freely. It consists of 40 bytes.

5.2 Fixed Device Status

Fixed Device Status records the following information.

(1) Device ID

Capacity	: 16 bytes	
Description	: Function type	FT_0 only
	Function definition 1st	Xa,Ya,Xb,Yb,A,B,C,D,Start
	Function definition 2nd	None
	Function definition 3rd	None
Data	: 00h-00h-00h-01h –00h-3Ch-09h-0Fh -00h-00h-00h-00h -00h-00h-00h-00h	

(2) Destination

Capacity	: 1 byte
Description	: World wide
Data	: FFh

(3) Connection direction

Capacity	: 1byte
Description	: Expansion socket None
Data	: 00h

(4) Product name

Capacity	: 30 bytes
Description	: "Maracas Controller" in hankaku characters.
	A space code (20h) is inserted for unused space.

(5) License

Size	: 60 bytes
Description	: Generally, it designates "Produced By or Under License From SEGA ENTERPRISES,LTD."
	A space code (20h) is inserted for unused space.

(6) Standby current consumption

      Size   : 2 bytes

      Description   : 100mA

      Data   : 04h-4Ch

(7) Maximum current consumption

      Size   : 2 bytes

      Description   : 130mA

      Data   : 05h-46h

5.3 Free Device Status

The Free Device Status area is available for product planners, developers, designers and programmers to enter any information they wish. The host obtains this status by the All Device Request.

In the Maracas Controller, the following 40 bytes of data are recorded in this status.

`"Version 1.010,2000/02/03,315-6211-AS  ,"`

`"Attention : D,Z button is Lost Flag. nyo"`

6   Afterword

Until the official version (Rev. 1.0) is distributed, contents will be modified to a small or large extent.